Seismic detection of serpentine and water mass transfer in subduction zone

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Serpentinites have a lower density and lower viscosity than ”dry” ultramafic rocks and it was proposed, based on numerical simulations, that they play a major role in mantle-slab decoupling, and in downward (sink) or upward (exhumation) motion of eclogites and ultra-high pressure (UHP) rocks in subduction zones. Rheological data on antigorite, obtained over a P-T range covering most of its stability field, confirm that serpentinites acts as a weak layer that allows significant mass transfer along the ”serpentinized channel” and dynamic processes such as mantle slab decoupling, and mantle wedge convection. Models of growth and transport of a serpentinized channel using available kinetic and present rheological data explain high exhumation rates of eclogites and limited thickness of the channel at great depths (above 50 km), and slower exhumation at in a thick hydrated mantle corner at shallower depths. Such channels may be difficult to detect from sismic tomography or using guided waves because of their small thickness (less than 2-3 km). Progress in the determination of elastic properties of serpentine minerals to solve this issue is presented. It is shown that the present knowledge of bulk aggregate properties allows to detect large masses of serpentines in the mantle corner. Detection of the deeper thin serpentine channel will mostly depend on our ability to model the anisotropy of the deformed aggregates.

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